



Detailed Forensic Report Certification

I, Paul C Greene, declare:

That I am Customer Support, Lead Engineer at SST, Inc. I have personal knowledge of the following matter, and, if called as a witness, could and would testify thereto. I have prepared the report and any attachments, identified below, which is attached hereto.

I declare under penalty of perjury under the laws of the State of Arizona that the report is true and correct.

Report:

City :	Richmond, CA
Zone :	3
Reference Date :	14 SEP 2014
Customer's Ref. #:	
Report Date :	18 SEP 2014
MD5 Hash (PDF):	3FAED76EA1CF54E44C242CD5F78897A0
SVN Revision (PDF):	59770

Executed this 2 of OCT, 2014, at SIERRA VISTA, AZ.

Paul C Greene

pgreene@shotspotter.com



Detailed Forensic Report

City : Richmond, CA
Zone : 3
Reference Date : 14 SEP 2014
Customer's Ref. #:
Report Date : 18 SEP 2014

Shooting Description

At 00:15 (12:15 AM) hours on September 14, 2014 ShotSpotter detected a Multiple Gunshot incident in Richmond, CA. ShotSpotter recorded the incident as Flex ID #106468 and located it at 3401 Cutting Blvd.

Incident Time Analyzed

The spool data was reviewed for 00:15 hours on September 14, 2014.

Position With Respect to the Coverage Area

Figure 1 – ShotSpotter Coverage Area displays the ShotSpotter coverage in Richmond, CA at the time of the incident. The red dashed line denotes the edge of the ShotSpotter coverage area, the red dot indicates the location of the shooting incident, and the triangle symbols represent sensors that participated in detecting the incident.



Figure 1 - ShotSpotter Coverage Area Richmond, CA



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Auto-detected by ShotSpotter? Yes

About ShotSpotter

ShotSpotter was installed in Richmond, CA in 2009. ShotSpotter has three primary components: acoustic sensors, a Location Server application, and the ShotSpotter Flex user interface. The ShotSpotter Location Server is hosted by SST, Inc. and runs on a virtual server at a remote facility, the ShotSpotter Flex user interface resides on a PC at the customers dispatch facility, and the acoustic sensors are deployed in geographic areas that are designated by the customer.

Each sensor is triggered by impulsive sounds in its environment. The acoustic measurements of these impulsive sounds are passed to the Location Server as possible gunshot sounds. The Location Server analyses the data received and determines if the impulsive sound can be located and classified as gunfire. If the impulsive sound can be located and classified as gunfire it reports the incident to the user interface. The user interface, referred to as the Flex Alert Console, provides an actionable view of the incident with an emphasis on the time and location that it occurred.

ShotSpotter detects and properly geo-locates (provides latitude and longitude) 80% of detectable outdoor incidents within the coverage area, accurate to within a circle whose radius is 25 meters. SST, Inc. does not guarantee 100% detection because real world, urban environments may contain intervening buildings, topography, foliage, periods of increased traffic or construction noise, and other urban acoustic noises that may either prevent the sound of a gunshot from being detected by the sensors(s), or may change or modify the audio characteristics of the sound of a gunshot so that it no longer matches the sensor(s) detection parameters.



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Analysis

Figure 2 – Incident review At 00:15:46 on September 14, 2014, ShotSpotter detected and located a Multiple Gunshot incident in Richmond, CA. The ShotSpotter Incident Review Center published the event to the customer at 00:16:24. Below is a table which shows the timeline of the incident being updated.



Search Results		M 106468
Source:	RichmondCA	
Details:	3 ROUNDS	
Rounds:	3	
Address:	3401 Cutting Blvd	
District:		
Beat:	3	
Latitude:	37.925398	
Longitude:	-122.336945	
CAD ID:	150	
Date/Time:	9/14/2014 00:15:46	
	View this incident on ShotSpotter Siren website (requires Siren login privileges)	
	Copy link to ShotSpotter Siren website for this incident (for email, etc.)	
shotspotter@waiser	Published	Sep 14 00:16:24
DNORTON@RICHMONDPD.NET	Acknowledged at customer facility	Sep 14 00:17:12
lcane10@richmondad.net	Closed at customer facility	Sep 14 00:18:11
DNORTON@RICHMONDPD.NET	Closed at customer facility	Sep 14 01:41:45
vlorique@richmondpd.net	Closed at customer facility	Sep 14 06:27:55

Figure 2 – Flex ID #106468 Incident review timeline



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Figure 3 – Address Location displays the locations calculated by ShotSpotter. The address of 3401 Cutting Blvd was read from a database of parcel information provided by the city or county and uploaded into ShotSpotter. The red dot indicates the location of the shooting incident as calculated by ShotSpotter in real-time and reported to the ShotSpotter operator.

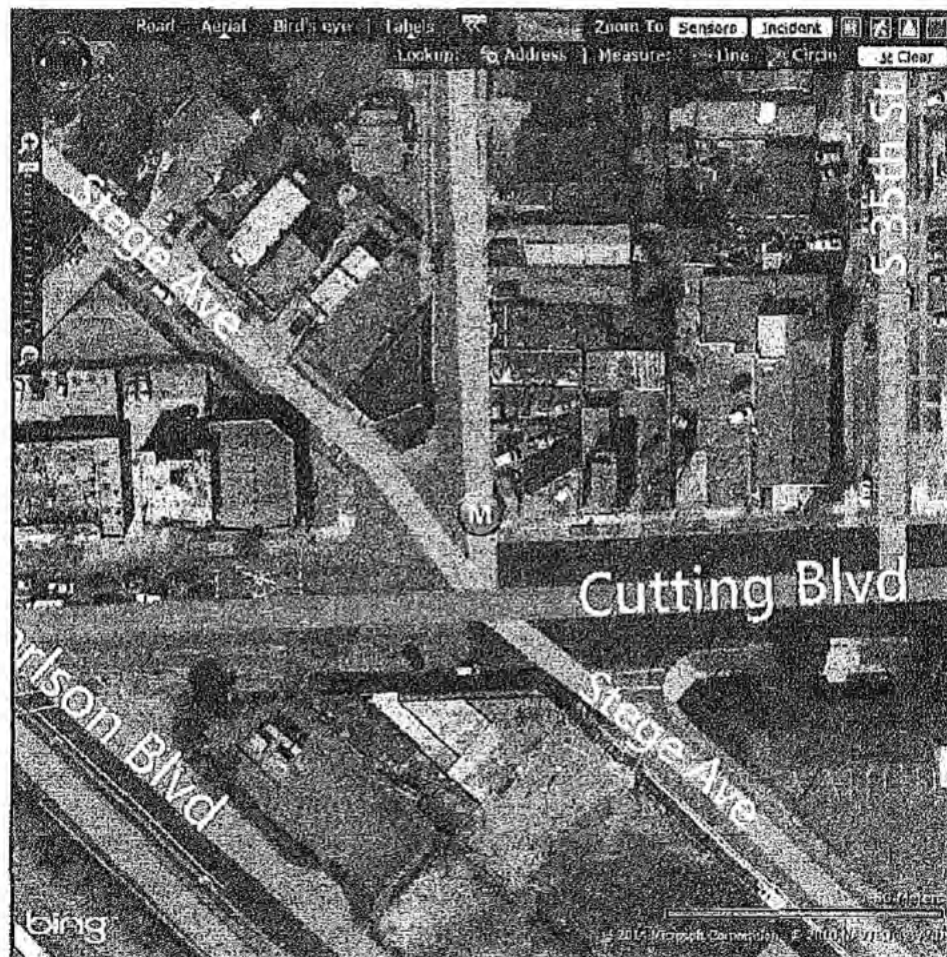


Figure 3 – Flex ID #106468 Flex Location



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Table 1 – Timeline of Discharge of Shots: The following table shows the time of discharge for each of the rounds which comprise this shooting event. The times listed below are the time the system calculated the trigger was pulled based on the environmental conditions at the time of the event. These times precede the time at which the system notified the ShotSpotter Operator listed because of small radio, computational, and network delays. All times are obtained from system and sensor clocks that are synchronized to GPS time, which is in turn synchronized with the atomic clock at the National Institute of Standards and Technology in Boulder, CO.

Shot	Time
1	00:15:46.1
2	00:15:46.6
3	00:15:47.2

Table 1 – Shot timeline, Flex ID #106468



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Figure 4 – Individual Shots Fired The following image plots the location of each round fired in Google Earth. This image is created by post-processing the archived data. Post-processing is a "manual" re-evaluation of the archived data through software tools that duplicate the real-time location algorithms that are a resident part of the ShotSpotter Location Server. Post-processing can be selectively performed on subsets of the raw data so that noises from different sources can be isolated for analysis.

In the image below the red dots indicate the location of each of the rounds fired. The locations calculated in post-processing are not identical to but within normal limits of what the ShotSpotter calculated in real-time. The red circle indicates a 25m margin of error radius for gunshot incidents that occur within the boundaries of the coverage area depicted on page 1 and is present in the image for reference only.

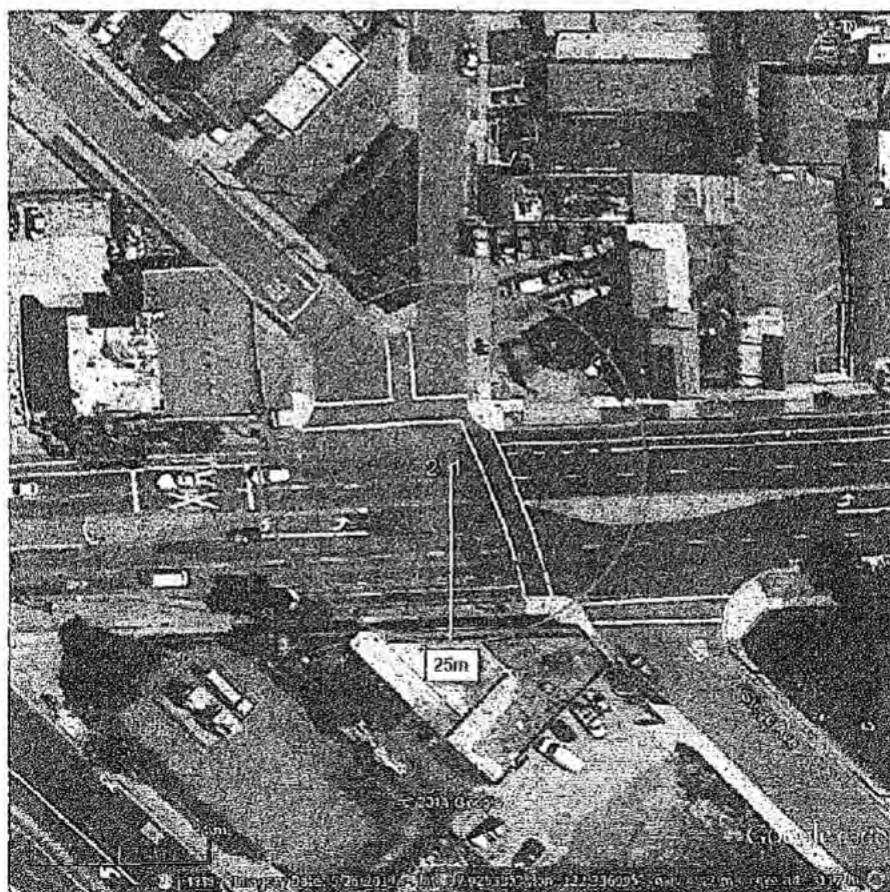


Figure 4 – Individual Shot Locations, Flex ID #106468



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Possible Sources of Error

The firing of a gun or an explosive device creates a loud, impulsive sound that is detectable above urban background noise up to two miles away from the firing incident location. The operation of ShotSpotter is understandably subject to the laws of physics and acoustic propagation.

The source of a pulse (a bang boom or pop) is located using triangulation. Triangulation requires a minimum of three sensors that surround the source to accurately measure the time when the sound was detected by each sensor. When more than three sensors participate in the detection, an automatic calculation will find a solution which minimizes the error to the greatest extent possible.

Figure 5 – Triangulation Flex ID #106468 was detected by 11 sensors.

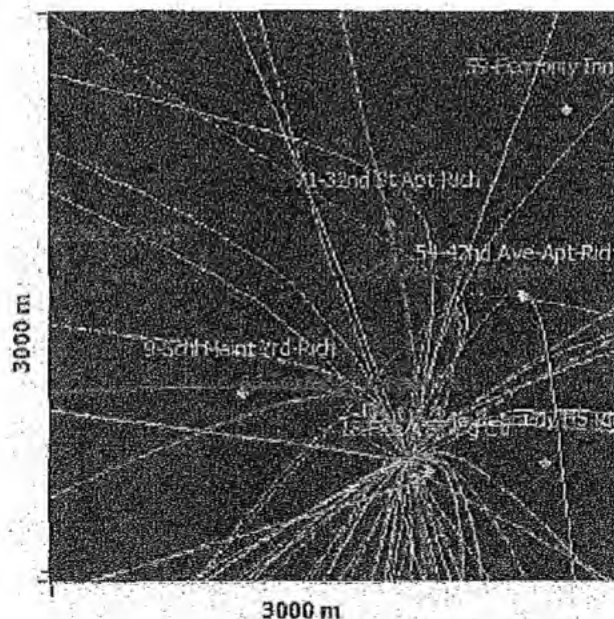


Figure 5 - Triangulation, Flex ID #106468



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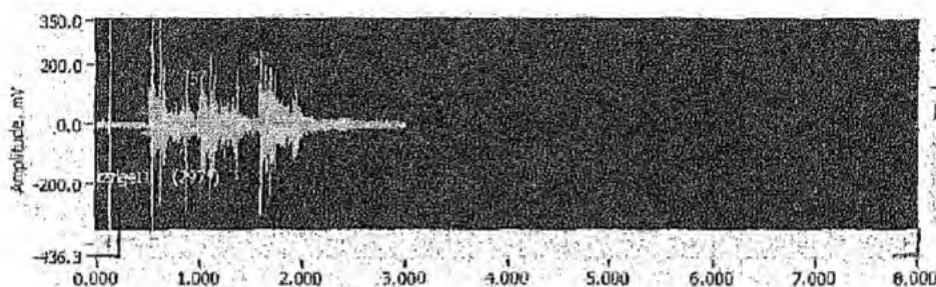
Reference Date : 14 SEP 2014

Customer's Ref. #:

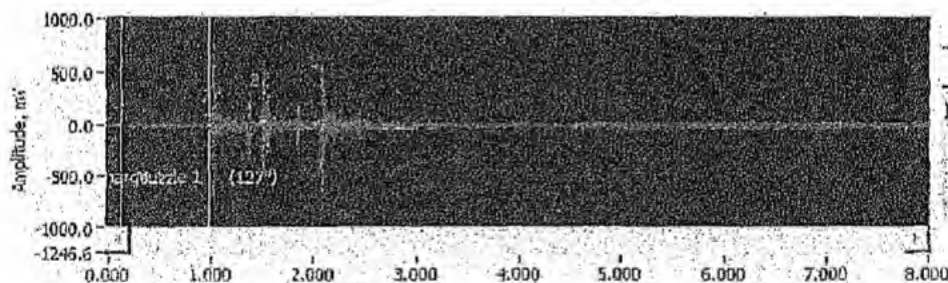
Report Date : 18 SEP 2014

Site-specific Acoustics

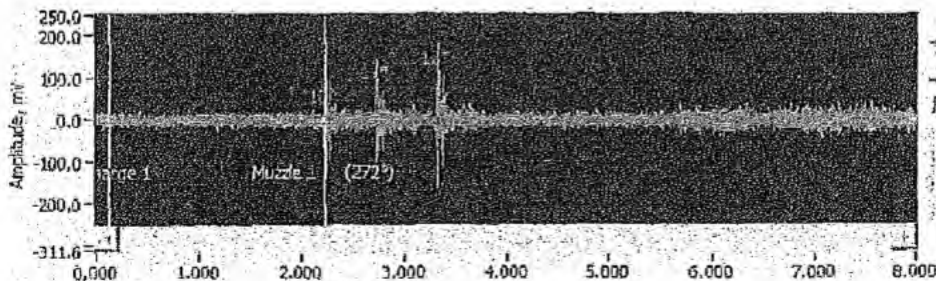
The sound of these shooting events can be heard on many sensors. Below are pictorial representations of the audio files and a link to the .wav file for three sensors close to the incidents. The depicted audio waveforms and audio clips represent 8.0 seconds of audio that was manually downloaded from each participating sensor. (Double-click on the speaker icons to play the audio from each sensor.)



Sensor 18 (141m)



Sensor 35 (289m)



Sensor 46 (725m)



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Conclusion

At 00:15 (12:15 AM) hours on September 14, 2014 ShotSpotter detected a Multiple Gunshot incident in Richmond, CA. ShotSpotter recorded the incident as Flex ID #106468 and located it at 3401 Cutting Blvd.

After review, the locations and times of three rounds fired were calculated.

Acoustical data analysis of a gunfire incident is complex and not comprehensive. The conclusions above should be corroborated with other evidentiary sources such as recovered shell casings, and witness statements.



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Certification and Acknowledgement

Certification

I, Paul C Greene, declare that I am, Customer Support Lead Engineer at SST Inc. I have personal knowledge of the matter referred to in this report, and, if called as a witness, could and would testify thereto. I declare that the above is true and correct.

Executed this 2 of OCT, 2014,

at SIERRA VISTA, AZ.

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Arizona All-Purpose Certificate of Acknowledgement

State of Arizona)
County of Cochise)

On October 2, 2014

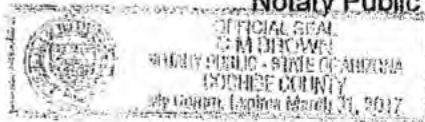
before me C. M. Brown, Notary Public personally appeared Paul C Greene who provided to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity, and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of Arizona that the foregoing paragraph is true and correct.

Witness my hand and official seal.

Signature

Notary Public



(Seal)